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OPHTHALMIC CASUALTY MANAGEMENT

VIETNAM REVISITED

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It is a special privilege for me to have been invited to speak with you today. Humbled by the opportunity to return to Bethesda where I am proud to have served as an ophthalmology resident, I feel especially honored to be a spokesman for many fine Navy Ophthalmologists who served with distinction during the Vietnam War. I wish to express particular gratitude to Drs. Dale Sponaugle, Frank Hoefle, Dave Davis, and Blackie Bruner, as well as John Karickhoff from the Army, for their invaluable contributions to this presentation.

At the same time, this topic is not an easy task for a number of reasons: First, no official system was created for studying or providing follow-up on the initial management of Vietnam eye injuries; Secondly, notwithstanding the excellent model provided by Army Theater Consultant in Ophthalmology during the Korean War, Colonel Forrest Hull, no such mechanism for assisting freshly trained Navy ophthalmologists, inexperienced in combat surgery, was available to share information in Vietnam. I understand the Army suffered a similar information vacuum among its Vietnam ophthalmologists. Finally, and make no mistake about it, the inept political prosecution of the Vietnam War, in general, and the occasional lack of senior medical administrative support, caused intense anger among many physicians. It aggravated the already negatively charged emotion associated with the

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exhausting, day-in and day-out demands of caring for the multitude of dying or maimed American youth. Recalling the experience is still difficult, with much, I'm sure, either forgotten or repressed. Having said that, let me try to give you some idea of the experiences that did occur, in hopes that you may better appreciate and deal with similar problems faced in future conflicts.

My comments will be confined to casualty management in I Corps, the northern-most part of South Vietnam. We even had our own Medical Society, with CAPT Smokey Stover, III 3rd Marine Amphibious Force Surgeon, as President. I served in the Station Hospital, Naval Support Activity, DaNang, first on the general surgery service, then for 10 months in an ophthalmology preceptorship between May 1968 and May 1969. NSA Hospital was the prototype combat zone Fleet Hospital with helo-pad, a capacity of 720-beds, 12 operating rooms, and more than 700 medical department personnel assigned. For your orientation, this is MAG-16, the Marine Helicopter Gunship Facility across the highway, the South China Sea to the East, and Viet Cong country to our West. The hospital ships Repose and Sanctuary steamed off the I Corps coast, usually one ship each stationed North and South at any given time. One fully-trained ophthalmologist was assigned to each ship as well as to NSAH, DaNang. The Army established the 95th Evacuation Hospital at DaNang where the ophthalmologist had completed approximately two years of his residency.

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Guerrilla warfare in Southeast Asia exacted a terrible toll on American and Asian lives, in addition to shattering thousands more who, through either good fortune or sometimes bad luck, survived their wounds. Fifty-six thousand were killed. Three-hundred and eight thousand were wounded--5,000 of whom died of their wounds.

COL Bellamy has noted that more Army, Navy, and Air Force casualties sustained minor wounds not requiring hospitalization than those who were hospitalized, an uncommon ratio when compared to prior conflicts. This reversal may reflect either less severe battle conditions for many troops in Vietnam or a different distribution of combatant and non-combatant forces than in previous wars. Marine Corps casualties were obviously more severe with a greater number requiring hospitalization than not. Marines were also killed at a rate double that for the Army from 1967-1969. It is noteworthy that 98% of total wounded survived, which probably reflects the speed of evacuation by helicopter as well as definitive care hospitals in the combat zone. On the surface, survival chances were greater in Vietnam than during any previous war. However, as COL Bellamy points out, if one excludes the lightly-wounded, "Carded-For-Record-Only" casualties, the mortality rate for the Army in Vietnam was 3.5%, significantly worse than the

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2.4% mortality of those similarly wounded in Korea. It is likely that the transit time from wounding to hospital was rapid enough so that some casualties survived the battlefield that might not have done so in either Korea or World War II. We'd like to think that the lower 2.8% Died Of Wounds figure for the Marine Corps reflected the superb care available from the FMF corpsmen through the definitive care hospitals in I Corps, both ashore and aboard ship. In fact, in the Surgical Data Base at NSAH, DaNang, the mortality rate, excluding nonsalvageable wounded, was an even better 2.1%.

The CH-46 Sea Knight was a vehicle of opportunity for the Marines, who had no designated medical evacuation helicopters, and could carry up to 23 casualties in a single load. Dave Davis on the Sanctuary was tremendously impressed with the dedication and competence of the Army's "Dust-Off" chopper pilots. As you can see, it too was really hazardous duty and some of these brave airmen were lost.

Our control of air space and helicopter evacuation permitted significant reduction in casualty transit time from wounding to definitive care. This was 6-12 hours in WW II, 2-4 hours in Korea, and an average of 2 1/2 hours at NSAH, DaNang. For nearly 50% of casualties received at DaNang, transit time was less than 1 hour. Alternatively,

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helicopter evacuation to the hospital ships was only an additional short hop across the beach, where the ships were often positioned in support of designated battlefield operations. Sanctuary's adopted mascot was Snoopy and its motto was "You find 'em; we bind 'em". In order to help preserve sanity and to give each other a change of pace, Dave Davis of the Sanctuary traded places for a spell with Ron Barnet at NSAH, DaNang. A man clearly ahead of his time, Dr. Davis established a prototype ambulatory surgicenter while at DaNang, complete with handicap ramp.

This stalwart group is the Department of Surgery at NSAH, DaNang in May of 1968. It included Chief of Surgery, CDR Jim Grisamore, who was preceded by Navy Cross recipient CAPT Harry Dinsmore, and was followed by CDR Vern Fitchett. Ron Barnet was the first staff ophthalmologist, seated next to yours truly. CAPT Dick Lawrence was a splendid CO, providing inspired leadership and great organizational skills. I had two real heroes, though. Most important was my mentor, great friend and Chief of Ophthalmology, Dale Sponaugle, who had just completed his Naval Hospital, San Diego, residency, shown here with our Korean Marine Battalion Surgeon. Secondly, Herb Proctor, caught in a lighter moment cleaning our "hootch's" comshaw reefer, was an incomparable general surgeon and Director of the Surgical Research Unit, whose critically important Surgical Data Base studies have been reported on by McCaughey, Garrick, Carey and Hirsch.

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What is the magnitude of combat injury anyway? Do those in civilian trauma centers have a good feel for combat mass casualty problems? We'll return to DaNang and the South China Sea and review representative experiences to answer that question in a moment.

In the first half of this century, the overall incidence of ocular war injuries hovered about 2-3%, with notable exceptions during parts of World War I and World War II. However, in Vietnam and the Mid-East Wars, the incidence of eye injury definitely increased. In fact, at DaNang, 8-9% of casualties undergoing initial major surgery had significant ocular wounds. Failure to appreciate the gravity of ocular injuries sent to a major referral hospital for head trauma allowed medical planners to seriously underestimate ophthalmic surgical staffing needs.

Casualties were most likely to have sustained multiple system injuries with 75% caused by fragmentation devices: artillery, mortars, rockets, mines, booby-traps, and grenades. Casualties were rapidly moved by litter from medevac choppers to a barricaded and sand-bagged triage area. Here, 8 primary and 20 overflow patients would receive rapid assessment and life-saving procedures. Airway obstruction, chest wounds, arterial bleeding and

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shock were obvious priorities. Following initial stabilization, casualties were carried to the adjacent radiology quonset hut where each body region with a wound was x-rayed. Caldwell, lateral, and Water's films were a minimum for any fragment wound about the eyelid or orbit. From there the casualty was hand carried to another adjacent quonset, to the right of this walkway, designated the preop holding area, where continuing reassessment and resuscitation measures, specialty evaluations, and clean-up prior to surgery were accomplished. Therefore, the ophthalmologist spent most of his triage time in the preop area. A cogent history and thorough but rapid ocular examination was performed, as many patients had more serious neurosurgical or thoraco-abdominal wounds that required priority surgery. Visual function was quantified and a systematic assessment of ocular and adnexal structures conducted. If, as was common, voluntary eyelid opening was difficult, topical anesthetic was instilled, maximum reassurance given to allay anxiety, and the patient cautioned against eyelid squeezing. The force generated by orbicularis contraction, as also from inadvertent pressure by the examiners fingers, could easily force vitreous or other intraocular contents through an ocular penetrating wound. If Desmarres eyelid retractors were not available, John Karickhoff reminds us that bent paperclips are an excellent improvisation. There were times, however, when prudence dictated that complete examination be deferred until general anesthesia was underway.

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No hand held slit lamps were available, so a bright hand light, loupes and the high plus lenses in the direct ophthalmoscope were often the only means for evaluating the anterior segment and lens in the supine casualty. Dr. Davis used the Sanctuary's operating microscope to examine some of his litter patients. Indirect ophthalmoscopy with wide pupillary dilation, completed the assessment of the posterior segment, media clarity permitting. Estimating any asymmetry of intraocular pressures was done extremely gently as a last observation and, then, only if no other clinical signs of ocular penetration were present. Observation of cautious corneal indentation with a muscle hook offered a useful method of estimating intraocular pressure--since there were no Perkins applanation tonometers--and could be done safely. A soft eye together with an abnormally deep anterior chamber was good evidence for an ocular penetrating injury.

Of 4,400 emergency surgeries at DaNang, 375 major eye cases were performed, 330 of which were penetrating ocular wounds. Since we were a major referral facility with a full range of specialty surgical care, including neurosurgery, our percentage of ocular injuries was higher than most. If we had tabulated less severe ocular injuries, not requiring major surgery, I'm sure the

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percentage of total ocular injuries compared to total combat wounded would easily have exceeded 10%. Penetrating wounds we saw were bilateral in nearly 10% of cases, which also included 77 intraocular foreign bodies. The 54% extraction rate of those attempted is low, which I'll explain later. The most devastating statistic deals with 168 enucleations--7 cases of which were bilateral-- and is certainly a reflection of the severity of fragment wounds we saw, an observation shared by Dr. Davis on the Sanctuary, Dr. Bruner on the Repose, and Dr. Roy during the following year at DaNang.

To give you an idea of how easy it was to fill up 7 days a week, our major surgery load increased to 435 for the 10-month period, with 60 Vietnamese civilian elective cases. This MEDCAP endeavor was most gratifying, built incalculable goodwill, and involved extraordinarily unusual diseases which, unfortunately, we do not have time to discuss today. In addition to the surgery load, we averaged about 25 patients per day, 6 days per week, in clinic visits for a total of 7,000 for this 10-month period.

Just to show the trend in casualty loads, you can see the volume of cases accelerate from 1966 to 1969 beginning with Dr. Hoefle's 119 cases, Dr. Davis's 360, and our 435.

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Even superficial injury in the combat casualty was more complex, as this blast injury from an exploding M-60 machine gun, caused multiple partial penetrating foreign bodies and subconjunctival hemorrhage. These hemorrhages, when somewhat larger and more dense, could easily mask a scleral perforation. Exploration of Tenon's space was performed frequently to assure detection and repair of underlying scleral wounds, especially cases in which radiographically documented orbital fragments were equivocally intraocular. Among 24 such explorations, I discovered six scleral perforations and four extraocular foreign bodies that were removed.

Isolated anterior chamber foreign bodies, the easily visualized intraocular foreign body and even this discrete, perforating corneal and penetrating lenticular foreign body were significantly less common than seen in a civilian peace-time setting. As mentioned previously, multiple fragment wounds were the rule from various projectiles, mines, booby-traps and grenades. Fragment velocities ranged up to 6,000 feet per second. They produced injuries such as this mortar blast to the head and neck, as well as to this Marine's left eye, treated by Dr. Hoefle on the Repose. Dr Karickhoff, at the 95th Evacuation Hospital, woefully entitled this devastating blast injury, "Where do I begin?" Many wounds, either because of soil, or even fecal contamination in booby-traps, or delay in transport,

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were grossly contaminated on arrival and created special challenges for debridement and antibiotic therapy, as we will discuss later.

Corneal perforating wounds ranged from small corneal perforations with discrete iris incarceration to explosive wounds with iris prolapse, and others with loss of corneal substance. The approach to restoring water tight integrity to the anterior segment was difficult and involved multiple perpendicular sutures, usually of 7-0 silk and sometimes utilizing a mattress technique for stellate perforations. It may seem crude by today's standards, but with only loupes, and neither an operating microscope, 10-0 nylon suture, Healon nor Cyanoacrylate adhesive, our choices were limited to fairly primitive closure techniques. Drs. Hoefle and Davis had microscopes on the hospital ships and access to preserved corneas from Ceylon, so were way ahead in their handling of severe corneal wounds, especially those requiring free hand grafts.

Orbital fragment wounds often required evaluation for intraocular foreign bodies but were usually not amenable to Sweets or Comberg localization because of multiple orbito-facial wounds and the inability to gain from the severely wounded patient, the cooperation necessary for special positioning. Dr. Hoefle devised an ingenious, leaded corneal contact lens that he found helpful in

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foreign body localization when used in conjunction with conventional x-ray views. This case of a perforating corneal wound and intraocular foreign body demonstrates how radiopaque fragments can be measured from the corneal contact lens shadow to estimate intra- or extra ocular location. As Dr. Davis reminisces, however, most injuries were so severe, with collapsed globes, that even the corneal lens was useless and conventional x-rays alone were made to suffice. We also used lateral x-ray views with the patient looking in up gaze and then down gaze to help decide if fragments were intraocular.

With clear enough media, indirect ophthalmoscopy and a pulsing hand magnet moved from about 2 feet, cautiously ever closer to the eye, we were able to identify intraocular foreign bodies and ascertain their degree of magnetism. This worked sometimes even in cases with small amounts of obscuring vitreous hemorrhage, which would pulsate from an underlying iron-containing foreign body.

The surgical approach to intraocular foreign bodies varied depending on the location of the entrance wound, size and location of the foreign body, and presence of vitreous hemorrhage and traumatic cataract obscuring visualization. Foreign body extraction was attempted via entrance wounds involving the corneoscleral limbus or ciliary body, demonstrated by this case of Dr. Hoefle's, with successful

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removal of two small metallic foreign bodies.

Entrance wounds involving cornea or retina were repaired. Here, PA and lateral films also confirmed a 2-3mm intraocular foreign body, seen here after Dr. Hoefle's repair of this corneal entrance wound, followed by magnetic extraction via a separate pars plana incision. By three days postoperatively, the lens had become cataractous and was later aspirated, leaving a postop air bubble in the anterior chamber. One month later the cornea was clear, no infection present, and some useful vision was a likely outcome for this lucky Marine. Again, posterior wounds such as these were repaired and magnetic foreign bodies, when visible, removed anteriorly through a pars plana incision. Iron foreign bodies which are not removed, of course, become encapsulated, cause siderosis, and eventual functional death of the retina.

One of the great disparities I could never understand was that the busiest acute care hospital in the world in 1968, at NSA DaNang, was so inferior in its ophthalmic surgical equipment when compared to both hospital ships. The ships had operating microscopes while we used loupes, making incredibly difficult the closure of corneal wounds. Dr. Hoefle reported he had on the Repose, a complete foreign body localization facility with Sweets, Comberg, and corneal lens x-ray, Berman and ultrasonic localizers, a

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state-of-the-art cryotherapy unit, as did Dr. Davis on the Sanctuary, while we had none of these. The ships also had either a Giant magnet, shown here in use by Dr. Bruner, or Bronson magnets, while we were limited to a weakly powered Lancaster magnet for more than half the year, early supplications through the chain of command, notwithstanding. When we finally did get a Bronson magnet, our rate of intraocular foreign body extraction jumped from 50-75% of attempts. Although overall we were only 34 of 63 attempts or 54% successful, our improved rate of foreign body extraction with the Bronson became the same as Dr. Hoefle's entire series: that is, 12 of 16, or 75% of attempts at magnetic intraocular foreign body removal were successful. Here are the foreign body collections on the left that I extracted and those on the right that Dr. Sponaugle extracted from eyes or orbits at DaNang. The smallest fragments on the right are less than 100mg and the largest column are greater than 500mg.

A major problem for all surgical services was prophylaxis and treatment of postoperative infection. For ophthalmology, of course, endophthalmitis was the dreaded fear, since neither vitrectomy nor intraocular antibiotics were part of our armamentarium to prevent certain loss of visual function, if not the eye itself. Antibiotic therapy was largely empiric, based on broad coverage for gram positive and gram negative organisms. This regimen was

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usually determined by the general surgeon caring for the multiply wounded casualty. Common treatment regimens included high doses of intravenous penicillin and streptomycin or cloramphenicol. We also used subconjunctival ampicillin for all penetrating ocular wounds. I recall only scant few cases of our own postoperative endophthalmitis, but will never forget the totally necrotic cornea present in one Marine on the first postop morning following fragment wound repair, whose anterior chamber tap grew out both Bacillus and Clostridia. Dave Davis mentioned only three cases during his year on the Sanctuary. MAJ Dale Anderson reported from the 24th Evacuation Hospital, an 8-13% incidence of endophthalmitis, in spite of a regimen of IV and subconjunctival antibiotics, including cloramphenicol and colymycin. Data collection on the incidence of endophthalmitis was difficult as patients were commonly transferred to Clark Air Force Base in the Philippines or to PACOM hospitals within 72-96 hours.

Myron Tong later published a study from 1968 on Surgical Data Base casualties at NSAH, DaNang. These were the most common G+ and G- organisms in cultures from extremity wounds on Day #1 and, presumably, reflect common battlefield wound contaminants. A preponderance of the more G- organisms, highlighted in red, dominated wound infections by Day #5. Sepsis was, unfortunately, not

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infrequent and the asterisked organisms were those most likely isolated on blood cultures. Penicillin, Cephalosporins, Colistin, and Kanamycin were the recommended antibiotics based on this study. Carbenicillin and Gentamicin had not yet come on the scene. Intravenous antibiotics targeted against anticipated soil-based organisms and with significant ability to cross the blood-eye barrier must be utilized in combination with periocular administration for all penetrating ocular injuries. The 1988 NATO Handbook of War Surgery presents currently suitable choices, including Gentamicin and Cefoxitin, a second generation Cephalosporin which is stable to B-Lactamases. Taken one step further, Len Parver reports from National Eye Trauma System data that no endophthalmitis has occurred from a bacillus organism when Vancomycin was part of the antibiotic regimen. Mitchell Opremcak, formerly at the Massachusetts Eye & Ear Infirmary, and now at Ohio State University, favors adding intravitreal Vancomycin and Amikacin, if a contaminated penetrating wound is suspected. Topical cycloplegics and fortified antibiotics should be continued in the immediate postoperative period, as well as during the evacuation chain.

Let me digress for a moment to remind you that even as one might be in the operating room or making rounds in a combat zone hospital, there are a few not insignificant

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distractions absent here at home. For example, there were frequent mortar and rocket attacks at night on either MAG-16, the Special Forces Camp or nearby supply dumps. Projectiles arched overhead from Viet Cong controlled rice paddies to our West. We always hoped whichever Cong packed the power charge used enough so that no short rounds would fall on the hospital compound. Such was not always the case. The Urology Clinic was 75% destroyed and the Orthopedic Ward significantly damaged by rockets early in 1968. Five patients and three hospital corpsmen were wounded, one quite seriously. Late in 1968, this convalescent ward and adjacent supply hut were blasted by a short round, causing structural damage and spraying the interior with fragments, but fortunately no casualties occurred among these convalescing patients.

If you were operating when the incoming sirens sounded, you just said a little prayer and kept working. If asleep in your "hootch", you donned flak jacket and helmet and either ran for the bunker or more often just crawled under your bed and prayed a little more.

Satchel charge attacks by Viet Cong "Sappers" were constant threats in the DaNang area. As a matter of fact, NSA Hospital was overrun in 1965 by Viet Cong with satchel charges and mortars. As seen from the hospital, the Air Force ammo dump at the DaNang Air Base was spectacularly

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blown up by the Viet Cong in 1969.

Finally, nightly staccato light shows took the form of helicopter gun ships and "Spook" or "Puff the Magic Dragon". This C-47's mini-guns, firing seven thousand rounds per minute, could put a single round in every square foot of an area the size of a football field. Intense parachute flares highlighted the landscape to dissuade any VC attacks on our perimeter.

Frank Hoefle set the tone when he echoed a maxim developed in the Korean War, that we should make every effort to suture all salvageable eyes regardless of vision. However, fragment wounds were seldom so selective and, all too often, the external appearance of the orbit was as seen in this casualty, who had no light perception in the left eye. Exploration revealed a ruptured globe, loss of significant intraocular contents and was, therefore, enucleated with an 18mm Silastic implant inserted. Following careful layered closure of Tenon's capsule and conjunctiva, associated eyelid and facial lacerations were repaired and a temporary tarsorrhaphy over pegs was placed to help resist the expulsive effect of postoperative orbital edema.

Dr. Hoefle made another point about orbital fragment wounds that was echoed by experience on the Sanctuary and at

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DaNang. Concurrent with severe wounds destroying the eye was the common presence of fractures of the orbital floor. A Caldwell-Luc approach to repositioning the orbital floor fragments with the support of a naso-antral pack was a simple and effective adjunct to the orbital repairs. Team surgery with ENT and Maxillo facial surgeons was a common and welcome approach to many orbito-facial wounds.

Apart from eyelid and facial wound repairs, the largest single surgical procedure for ophthalmologists was, sadly, enucleation. The incidence of primary enucleation in combat trauma varies quite widely, but if viewed as a percent of total penetrating ocular injuries, the differences are less broad. These differences likely represent legitimate variations in the severity of wounds transported to different hospitals, as well as the relative frequency of large versus small fragment wounding agents. Here, the enucleation rate of all penetrating ocular injuries on the Repose was 46% versus 51% for NSAH, DaNang. Comparable data from the Sanctuary is not available, although Dr. Davis recalled he performed well over 100 enucleations. It is of interest that the proportion of penetrating injuries that underwent primary repair both from the Repose and DaNang is a very comparable 20%.

Unfortunately, severe ocular injury, as with other combat tragedy, did not spare our dedicated hospital corpsmen. This large, double-perforating fragment wound occurred in a 3rd Class corpsman brought to the Repose. From the size of the missile apparent both on x-ray, and exiting the posterior globe, you could see why Dr. Hoefle enucleated this eye.

A 50-caliber machine gun round created a massively avulsive wound of this Korean Marine's face. Careful repair, however, by a team of DaNang ENT, plastic, and maxillo-facial surgeons, provided a foundation for later reconstructive surgery. Facial wounds were treated with minimal debridement and maximum reapproximation, including some sliding flaps, because of the generous blood supply to the face. Dr. Bruner demonstrates a nice example of the use of a Mustarde flap to close a large defect in the lower lid. In contradistinction, extremity wounds were debrided open and delayed primary closure performed 4-5 days later to prevent otherwise universal wound infection.

This photograph represents a tragic, yet touching story of a doctor-patient relationship that was rekindled in California several years after the original injury was treated by Dr. Davis on the Sanctuary. It took eight hours trying to repair 18-year old Gary Stadtmiller who, leading the point on a patrol, caught two AK-47 rounds in the

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face. In addition to the massive soft tissue and bony facial disruption, the right eye was ruptured and commotio caused blindness in the left eye. This photograph 10 years later shows Gary having recovered from a total of 150 reconstructive procedures, 75 of which were under general anesthesia. He weathered and recovered from a long period of substance abuse, married his therapist, obtained a degree in psychology himself, and is presently raising a beautiful family. It's a remarkable Phoenix-like story of a young man, who when first wounded, was originally left for dead. I've included in your handout a most instructive article by Mr. Stadtmiller about his disability and our society's response.

Dr. Davis also shared this incredible case in which a Vietnamese woman was struck by a flare cassette as it was descending to earth by its parachute. The open end of the flare casing acted like a razor blade, taking the skin off one side of her face while leaving her eye, orbicularis, and other tissues intact. An adept surgeon, Dr. Davis performed the necessary repairs in about two hours.

Concomitant intracranial wounds and orbital trauma were a regular occurrence, as Dr. Bruner can attest from this tragic case on the Repose. In fact, the orbit was frequently the portal of entry for central nervous system injury. As a consequence, the neurosurgeon and

ophthalmologist developed a close bond, with repair of ocular or orbital trauma often following several hours of neurosurgical care. COL Tredici, while at Clark AFB Hospital in the early Vietnam period, reported 40% of eye injuries having concomitant brain injury. This figure, roughly corresponds to that reported by Hull from the Korean War and showed no apparent decrease in incidence during the later Vietnam era. A fragment destroyed this Montagnard woman's globe prior to intracranial penetration, seen on PA and lateral x-rays. A maneuver always performed following enucleation in these cases was digital palpation of the orbital skeleton. Should a significant bony defect be found, no implant was inserted for fear of intracranial migration.

This bizarre wound from one of our own strafing aircraft entered above the brow of this young Vietnamese girl, ruptured the globe and eventually impacted against her vertebral column. A C5 - C6 paretic level resulted, somehow sparing innervation to the diaphragm. The missile is a 20mm cannon round.

Orbital injuries may occur in which the globe remains intact. It is commonly accepted that anteriorly located missiles or fragments may be removed with caution but posterior exploration results in more iatrogenic damage than that caused by the injury and are best left alone.

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Telltale chemosis and proptosis forewarned that this relatively innocent entrance wound in the left nostril terminated in the right mid-lateral orbit. The globe was contused but intact and this rifle round removed without incident.

You may have wondered why in an earlier slide depicting the NSAH triage area, this casualty's face was covered with a flak jacket and triage personnel were wearing flak jackets and helmets. As you can see, an adequate airway has been established, and the reason for all the protection is this M-79 grenade lodged in the left orbit. The grenade had obviously traveled an insufficient distance to become armed, although later inspection of the gyro-arming device revealed that it was jammed by a fracture in the gyro casing on impact. It is noteworthy that CDR Tom Faris was unaware that it was not a potentially live device when he courageously removed the grenade.

A large frontal bone fracture and cerebral damage required neurosurgical debridement and repair, but, curiously enough, only a small hyphema and vitreous hemorrhage characterized the ocular injury.

I would like to remind you that as devastating as some of the injuries are that I have presented today, there is a significant percentage of casualties who, from the moment

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of injury, will never see again.

This Marine raised his arms in a futile attempt to ward off an exploding grenade. His right eye was destroyed by one fragment and the left eye by his wrist watch band--a portion of which had become a secondary missile. He was one of 7 cases with bilateral enucleations. Such bilateral enucleations represented about 4% of cases, but 8% of enucleated eyes.

A sniper bullet destroyed this man's left eye and severed the optic nerve on the right.

The number of eyes with less severe injuries which ultimately lost visual function or subsequently came to enucleation may never be fully known. If estimates of total veterans' cost from the Vietnam War prepared by the Library of Congress are accurate, the portion due to ocular disability alone could run as high as four billion dollars.

Before closing, let me relay to you observations made by veteran combat surgeon RADM Ben Eiseman and MASH Surgeon Capt. Richard Hornberger that CAPT Arthur Smith cites to remind us how combat casualty management differs vastly from civilian trauma care and why training military surgeons must include the realities of the combat environment.

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RADM Eiseman writes, "Throughout their training, medical students are imbued with the principle not to compromise patient care. Nothing less than excellence is to be tolerated but, suddenly in a combat situation, compromise becomes necessary. The reaction of such a highly programmed physician is predictable: he becomes outraged, frustrated and resentful. In the comparative luxury of the Vietnam War, many medical officers were shocked by the occasional need to change the pattern of patient care from that which they practiced in civilian life. Physicians are a rigid, compulsive tribe, and in many cases, the cultural, professional and emotional shock of having to compromise patient care actually immobilized or rendered unfit the physician suddenly placed in a combat zone."

Capt. Hornberger sums it up best when he states, "...Meatball surgery is a specialty in itself. We are not concerned with the ultimate reconstruction of the patient. We are concerned only with getting the kid out of here alive, enough for someone else to reconstruct him. ...Our general attitude around here is that we want to play par surgery. Par surgery is a live patient." And how does a physician and surgeon with both human as well as external limitations imposed upon him keep it all together amid this carnage for a whole year? Certainly, the tremendous, mutually supportive relationships that are fostered among one's professional colleagues are essential. Those who

didn't cultivate those relationships didn't fare as well. Most important for me was the unwavering support of a lovely, courageous wife back home, doing an incredible job taking care of these great girls of ours, as well as our baby girl, whom I never saw until she was one year old.

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In closing, I would respectfully offer a few recommendations, some of which are pretty obvious but need further definition, and others of which are, fortunately, already underway:

RECOMMENDATIONS

- A. Early stabilization of eye injury to restore integrity of the globe.

To achieve the first goal, a secure, well-equipped and staffed combat zone facility must be available either ashore or afloat to care for approximately 10% of casualties with significant eye injury. Ashore facilities have large capacity, are weather independent, evacuation is easy, but assume we have tactical control of air and local ground space. Hospital ship facilities in both MERCY and COMFORT are of substantial size but have only limited operational supplies, evacuation is not easy and assume tactical control of air, surface and undersea space; there must be equipment for rapid and precise foreign body localization, including B-Scan ultrasonography and, perhaps, both CT scan and diagnostic x-ray spectrometry. Staffing must include two ophthalmologists, at least one of whom has some vitreo-retinal surgery training during residency,

provided with clear-cut guidelines for initial management of intraocular foreign bodies. Basic equipment for core vitrectomy should be added to the standard operating microscope, preserved corneal grafts, cyanoacrylate adhesive, and collagen shields. Intraocular antibiotics need to be strongly considered. Aero-medical evacuation within 7 days to a communications zone or evacuation zone hospital must be available for definitive management of anterior and posterior segment injuries.

B. Definitive care evacuation facilities similar to NETS Centers.

A communications zone or evacuation facility designed to receive and manage the evacuated patient with a stabilized globe should be staffed by ophthalmologists with sub-specialty training in vitreo-retinal, anterior segment and ophthalmic plastic surgery. A full surgical capability must exist to perform total pars plana vitrectomy, with use of intraocular micromagnets, intraocular forceps and endo-laser photocoagulation.

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C. Improved aero-medical evacuation communications.

Aero-medical evacuation communications must be highly developed with a coordination center for each regional combat zone. There must be the capability of monitoring the status of each medical facilities' current triage load, operating room access or backlog, and sub-specialists' availability. Only in this manner is it possible to assure even distribution of casualties by major wound types to casualty receiving facilities capable of prompt treatment.

D. Theatre Consultant (s).

Theatre consultants must be established for each service branch who will communicate with each other but whose primary responsibility is to facilitate communication among front line ophthalmologists on the latest of "What works in combat eye surgery". They should also be able to cut through red tape for critical equipment or staffing needs and to establish a system for feedback from convalescent hospitals to acute care facilities regarding the outcomes of early management choices.

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E. Eye Armor.

COL LaPiana has labored arduously over the last 20 years for the critical need to put in place a means of eye protection that is acceptable to the combat infantryman. The Soldier or Marine then needs to be educated in how to adapt to its use. At the very least there needs to be a universal requirement for minimum 2mm thickness polycarbonate spectacles for the correction of refractive errors in combat infantrymen.

F. Combat Ocular Trauma Management Course

Happily, this course is now a reality and I would only encourage that guest faculty include members of both ophthalmic and other surgical disciplines who are veterans of the Vietnam and Mid-East wars, in addition to civilian surgeon members of the National Eye Trauma System.

Well, I think I've kept you captive more than long enough and I do appreciate the kind attention you've given to this old short-timer whose orders have come and gone and whose wake-up is no longer quite the same. Thank You.

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I'd like to ask Dr. Bruner to come up and help me respond to your questions. As you may know, Dr. Bruner spent all of 1968 which included the Major TET offensive in treating combat eye injury aboard the Repose.